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(12) WORLD INTELLECTUAL PROPERTY AGENCY
(19) INTERNATIONAL OFFICE
INTERNATIONAL APPLICATION PUBLISHED
(10) BASED ON PATENT COOPERATION TREATY
WO 02/19848 A1

(43) Publication Date: March 14, 2002
(51) Int. Cl.[7]: A24C 5/14
(21) Application No.: PCT/JP01/07796
(22) Application Date: September 7, 2001
(25) Language of International Filing: Japanese
(26) Language of International Publication: Japanese
(30) Priority Data: No.: 2000-273800
Date: September 8, 2000
Country: Japan
No.: 2000-273801
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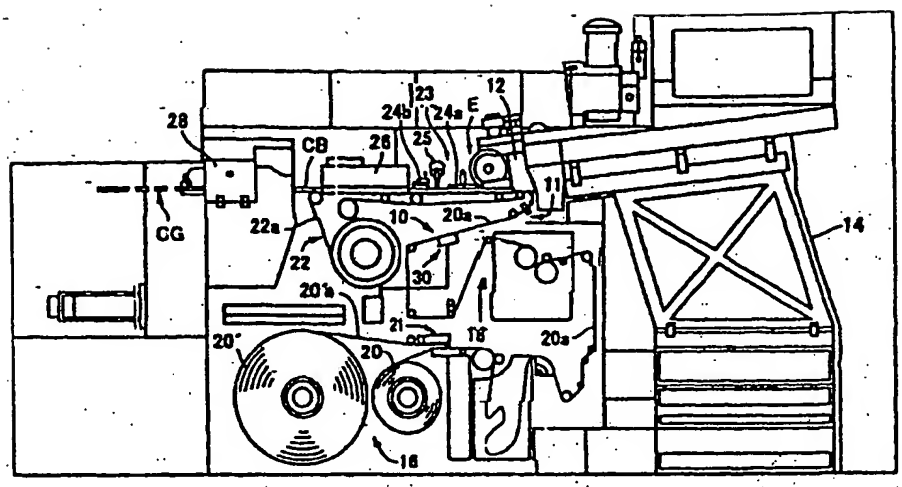
(81) Designated Contracting States (domestic): AE, AG, AL, AM, AT, AU,AZ,BA,BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
(84) Designated Contracting States (broad region): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
Accompanying Published Documents:
International Survey Report

For two-character codes and other abbreviations, see "Guidance Note of Codes and Abbreviations" described in the opening page of each PCT gazette being periodically published.

[There are no amendments to this patent.]

(54) METHOD AND DEVICE FOR PRODUCING LOW FLAME PROPAGATION CIGARETTE



(57) Abstract: A method of producing a low flame propagation cigarette wherein, even if the lighted cigarette is left on a combustible material, the self-extinguishing action of a combustion adjusting agent or the removal of heat of combustion by the combustible material prevents scorching from occurring in the combustible material or from advancing so much as in the past; and a device for producing a low flame propagation cigarette. The device of producing a low flame propagation cigarette comprises a combustion adjusting agent applied region forming unit (30, 30') for forming combustion adjusting agent applied regions in a plurality of longitudinally or peripherally spaced positions in a wrapping paper web (20a) being conveyed on a wrapping paper conveyer unit (18), a unit (14) for feeding cut tobacco to the wrapping paper having been formed with the combustion adjusting agent applied regions, a wrapping tube unit (23) for wrapping the wrapping paper having cut tobacco fed thereto into a cigarette form, and a cigarette cutting unit (28) for cutting the wrapping paper wrapped into a cigarette form into lengths corresponding to the length of a cigarette.

SPECIFICATION

Method and Device for Producing Low Flame Propagation Cigarette

TECHNICAL FIELD

The present invention pertains to a method for producing a low flame propagation cigarette and a device for producing a low flame propagation cigarette.

CONVENTIONAL TECHNOLOGY

The low flame propagation cigarette is a cigarette constituted such that it may not be burnt when holding after lighting, or is a cigarette constituted such that when holding after lighting, if it is erroneously dropped on a combustible material, in spite of its continuous combustion, the heat of combustion is removed by the combustible material, so that the combustible material is self-extinguished. The existence of the low flame propagation cigarette itself has already been well known from Japanese Patent No. 2783803.

In the low flame propagation cigarette presented in the above-mentioned patent journal, a combustion adjustor is spread in a ring shape at several positions mutually separated at a prescribed interval along the longitudinal direction of the cigarette in a wrapping paper. Subsequently, if the low flame propagation cigarette is left [not smoked] after lighting it, the combustion is extinguished when it arrives at the ring-shaped combustion adjustor. If smoking of the cigarette is continued after lighting, the combustion is not extinguished by the combustion adjustor, even if the combustion arrives at the ring-shaped combustion adjustor.

In the conventional low flame propagation cigarette with the above-mentioned constitution, it is burnt like an ordinary cigarette without a low flame propagation during the combustion among several ring-shaped combustion adjustors. For this reason, if the above-mentioned conventional low flame propagation cigarette is erroneously left on a combustible material during combustion among several ring-shaped combustion adjustors, the combustible material is not burnt until the combustion arrives at the ring-shaped combustion adjustor and is extinguished by the combustion adjustor; however, a severe scorching is caused in accordance with the type of combustible material.

The present invention considers the above-mentioned situations, and its objective is to provide a method and device for producing a low flame propagation cigarette in which the combustion is extinguished by a combustion adjustor, even if a lighted cigarette is erroneously left on a combustible material, or the heat of combustion is removed by the combustible material rather than burning the combustible material, so that scorching is prevented from being caused or from advancing as much as in the past.

PRESENTATION OF THE INVENTION

In order to achieve the above-mentioned objective of the present invention, the method for producing a low flame propagation cigarette of the present invention is characterized by: being equipped with a wrapping-paper conveying process that conveys a wrapping paper for a cigarette; a combustion-adjustor spread region forming process that forms combustion-adjustor spread regions for the wrapping paper being conveyed in the wrapping-paper conveying process; a cut-tobacco supply process that supplies cut tobacco to the wrapping paper in which the above-mentioned combustion-adjustor spread regions are formed in the combustion-adjustor spread region forming process; a wrapping tube process that wraps the wrapping paper to which the cut tobacco is supplied in the cut-tobacco supply process and the cut tobacco into a cigarette form; and a cigarette cutting process that cuts the paper wrapped along with the cut tobacco into a cigarette form in the wrapping tube process in accordance with the length in the longitudinal direction of the above-mentioned cigarette.

In the low flame propagation cigarette manufactured by the method of the present invention with the above-mentioned constitution, with the adjustment of each width and number of the combustion-adjustor spread regions, the time required until the self-extinguishment from the moment of being left after lighting and the temperature of the combustion, even if the combustion is continued without being self-extinguished, can be optionally set.

As a result, even if the lighted cigarette is erroneously left on a combustible material, the combustion is self-extinguished by the combustion adjustor, or the heat of combustion is removed by the combustible material without burning it, so that scorching can be prevented from being caused in the combustible material or from advancing as much as in the past.

In the method for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, needless to say, the wrapping paper conveyed in the wrapping-paper conveying process is a long web before being cut into each cigarette form. While such a long web-shaped wrapping paper is conveyed in the wrapping-paper conveying process, the combustion-adjustor spread regions are formed in the combustion-adjustor spread region forming process, so that the combustion-adjustor spread regions can be accurately formed at a desired number and a desired density.

In the method for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming process, the combustion-adjustor spread region forming operation is preferably carried out by synchronizing with the wrapping-paper cutting operation in the cigarette cutting process.

In the method for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, a combustion-adjustor spread region inspecting process

for inspecting the distribution (including the pattern and number) and density of the combustion adjustor bands formed for the wrapping paper in the combustion-adjustor spread region forming process is preferably further provided between the combustion-adjustor spread region and the cut-tobacco supply means.

With the formation of the combustion-adjustor spread regions in the combustion-adjustor spread region forming process between the long web-shaped wrapping paper being conveyed in the wrapping-paper conveying process, the combustion-adjustor spread regions can be accurately formed at a desired number and a desired density in a desired pattern, and the distribution (including the pattern and number) and density of the combustion-adjustor spread regions formed in this manner can be precisely inspected.

In this case, in the combustion-adjustor spread region inspecting process, light is projected from one surface of the wrapping paper for a cigarette after the combustion-adjustor spread regions are formed, then the transmitted light is detected from the other surface of the wrapping paper for a cigarette after the combustion-adjustor spread regions are formed. The distribution and density of the combustion-adjustor spread regions formed for the wrapping paper can be inspected by the intensity distribution of the transmitted light.

In the method for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming process, when the wrapping paper is wrapped into a cigarette form, the above-mentioned several combustion-adjustor spread regions are preferably formed on the inner surface of the wrapping paper.

In this manner, the appearance of the cigarette can be formed without a sense of incompatibility with conventional cigarettes, and the possibility that the above-mentioned several combustion-adjustor spread regions formed in the wrapping paper will be damaged for any reason during the storage of the cigarette is greatly reduced.

In the method for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming process, several combustion adjustor bands extended along the longitudinal direction can also be formed when the wrapping paper is wrapped into a cigarette form.

In the method for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming process, several combustion adjustor regions separated by a prescribed interval in the longitudinal direction and extended along the longitudinal direction can also be favorably formed when the wrapping paper is wrapped into a cigarette form.

The above-mentioned interval can be made to correspond to the length in the longitudinal direction of each cigarette. In this case, in the above-mentioned wrapping paper, the above-

mentioned combustion-adjustor spread regions are preferably not formed at a prescribed distance in the longitudinal direction when the above-mentioned wrapping paper is wrapped in a cigarette form from the lighting end when the wrapping paper is cut for each cigarette.

The reason for this is that immediately after the lighting end of each cigarette is lighted, the cigarette is seldom left and deterioration of the lighting performance is prevented during lighting.

According to the experiment of these inventors, the above-mentioned prescribed distance is preferably set in a range of about 10-25 mm.

Furthermore, since the conveying direction of the wrapping paper in the wrapping-paper conveying process is the longitudinal direction when the wrapping paper is wrapped into a cigarette form, preferably, in the combustion-adjustor spread region forming process, a roller makes contact with the above-mentioned wrapping paper conveyed in the wrapping-paper conveying process and rotates in the above-mentioned conveying direction, and combustion-adjustor spread region transfer regions corresponding to the above-mentioned combustion-adjustor spread regions are formed on the outer peripheral surface of the above-mentioned roller. The combustion adjustor is supplied to the outer peripheral surface of the above-mentioned roller from a combustion adjustor adherer, and the combustion adjustor is adhered.

When a roller is used in the combustion-adjustor spread region forming process, since the width and diameter (that is, the peripheral length of the outer peripheral surface) can be easily changed, as a result, the combustion-adjustor spread region transfer regions formed on the outer peripheral surface of the roller can also be easily changed.

Also, in the combustion-adjustor spread region forming process, a nozzle contacts or approaches the above-mentioned wrapping paper conveyed by the wrapping-paper conveying process, several nozzle holes are formed in the nozzle, and the combustion adjustor can be supplied to the above-mentioned nozzle from a combustion adjustor supplier.

When the nozzle in which several nozzle holes are formed is utilized in the combustion-adjustor spread region forming process, the jet timing of the combustion adjustor from the nozzle holes of the nozzle can be easily changed. As a result, in the combustion-adjustor spread region forming process, when the wrapping paper is wrapped into a cigarette form, a prescribed interval is opened in the longitudinal direction, and when several combustion adjustor bands are formed, the above-mentioned prescribed interval is easily adjusted, compared with the former combustion-adjustor spread region forming process using the roller.

In order to achieve the above-mentioned objective of the present invention, the device for producing a low flame propagation cigarette of the present invention is characterized by: being equipped with a wrapping-paper conveying unit that conveys a wrapping paper for a cigarette; a combustion-adjustor spread region forming unit that forms combustion-adjustor spread regions

for the wrapping paper conveyed by the wrapping-paper conveying unit; a cut-tobacco supply unit that supplies cut tobacco to the wrapping paper in which the above-mentioned combustion-adjustor spread regions are formed by the combustion-adjustor spread region forming unit; a wrapping tube unit that wraps the wrapping paper to which the cut tobacco is supplied by the cut-tobacco supply unit and the cut tobacco into a cigarette form; and a cigarette cutting unit that cuts the wrapping paper wrapped along with the cut tobacco into a cigarette form by the wrapping tube unit in accordance with the length in the longitudinal direction of the above-mentioned cigarette.

In other words, in the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, a low flame propagation cigarette is manufactured. Thus, all the advantages attainable with the low flame propagation cigarette manufactured by the method of the present invention as mentioned above can be exerted.

In the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, needless to say, the wrapping paper conveyed by the wrapping-paper conveying unit is a long web before being cut into each cigarette form.

In the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming unit, the combustion-adjustor spread region forming operation is preferably carried out by synchronizing with the wrapping-paper cutting operation in the cigarette cutting unit.

In the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, a combustion-adjustor spread region inspecting unit for inspecting the distribution (including the pattern and number) and density of the combustion-adjustor spread regions formed for the wrapping paper by the combustion-adjustor spread region forming unit is preferably further provided before the supply of the cut tobacco by the cut-tobacco supply unit after the formation of the combustion-adjustor spread regions for the wrapping paper by the combustion-adjustor spread region forming unit.

With the formation of the combustion-adjustor spread regions in the combustion-adjustor spread region forming unit between the long web-shaped wrapping papers conveyed in the wrapping-paper conveying unit, the combustion-adjustor spread regions can be accurately formed at a desired number and a desired density in a desired pattern, and the distribution (including the pattern and number) and concentration of the combustion-adjustor spread regions formed in this manner can be precisely inspected.

In this case, in the combustion-adjustor spread region inspecting unit, light is projected from one surface of the wrapping paper for the cigarette after the combustion-adjustor spread regions are formed; the transmitted light is detected from the other surface of the wrapping paper for the cigarette after the combustion-adjustor spread regions are formed. The distribution and

density of the combustion-adjustor spread regions formed for the wrapping paper can be inspected by the intensity distribution of the transmitted light.

In the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, preferably, the combustion-adjustor spread region forming unit is disposed such that it can make contact with the wrapping paper conveyed by the wrapping-paper conveying unit and is provided with a wrapping-paper contact and separation unit for selectively contacting the wrapping paper conveyed by the wrapping-paper conveying unit to and from the combustion-adjustor spread region forming unit.

In this case, the wrapping-paper contact and separation unit preferably separates the above-mentioned wrapping paper from the combustion-adjustor spread region forming unit while conveying of the wrapping paper of the wrapping-paper conveying unit is stopped.

In the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming unit, when the wrapping paper is wrapped into a cigarette form, the above-mentioned several combustion-adjustor spread regions are preferably formed on the inner surface of the wrapping paper.

In this manner, the appearance of the cigarette can be formed without a sense of incompatibility with conventional cigarettes, and the possibility that the above-mentioned several combustion-adjustor spread regions formed in the wrapping paper will be damaged for any reason during the storage of the cigarette is greatly reduced.

Furthermore, in the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming unit, several combustion adjustor bands extended along the longitudinal direction can also be formed when the wrapping paper is wrapped into a cigarette form.

Furthermore, in the device for producing a low flame propagation cigarette of the present invention with the above-mentioned constitution, in the combustion-adjustor spread region forming unit, several combustion adjustor bands separated by prescribed intervals in the longitudinal direction and extended along the longitudinal direction can be formed when the wrapping paper is wrapped into a cigarette form.

The above-mentioned interval can be made to correspond to the length in the longitudinal direction of each cigarette. In this case, in the above-mentioned wrapping paper, the above-mentioned combustion-adjustor spread regions are preferably not formed at a prescribed distance in the longitudinal direction when the above-mentioned wrapping paper is wrapped in a cigarette form from the lighting end when the wrapping paper is cut for each cigarette.

The reason for this is that immediately after the lighting end of each cigarette is lighted, the cigarette is seldom left and deterioration of the lighting performance is prevented during lighting.

According to the experiment of these inventors, the above-mentioned prescribed distance is preferably set in a range of about 10-25 mm.

Furthermore, since the conveying direction of the wrapping paper in the wrapping-paper conveying unit is the longitudinal direction when the wrapping paper is wrapped into a cigarette form, the combustion-adjustor spread region forming unit can be equipped with a roller that makes contact with the above-mentioned wrapping paper conveyed by the wrapping-paper conveying unit and rotates in the above-mentioned conveying direction, combustion-adjustor spread region transfer regions formed in accordance with the above-mentioned combustion-adjustor spread region on the outer peripheral surface of the above-mentioned roller, and a combustion adjustor adherer that supplies the combustion adjustor to the outer peripheral surface of the above-mentioned roller and adheres the combustion adjustor.

Also, the combustion-adjustor spread region forming unit can be equipped with a nozzle that contacts or approaches the above-mentioned wrapping paper conveyed by the wrapping-paper conveying unit, several nozzle holes formed in the nozzle, and a combustion adjustor supplier that supplies the combustion adjustor to the above-mentioned nozzle.

Also, in the former above-mentioned combustion-adjustor spread region forming unit using a roller, since the width and diameter (that is, the peripheral length of the outer peripheral surface) can be easily changed, as a result, the combustion-adjustor spread region transfer regions formed on the outer peripheral surface of the roller can also be easily changed.

Also, in the latter combustion-adjustor spread region forming unit using the nozzle, since the jet timing of the combustion adjustor from the nozzle holes of the nozzle can be easily changed, as a result, in the combustion-adjustor spread region forming unit, when the wrapping paper is wrapped into a cigarette form, a prescribed interval is opened in the longitudinal direction, and when several combustion adjustor bands are formed, the above-mentioned prescribed interval is easily adjusted, compared with the former combustion-adjustor spread region forming unit using the roller.

Next, the device for producing a low flame propagation cigarette according to the method for producing a low flame propagation cigarette in an embodiment of the present invention is explained in detail referring to the attached figures while mentioning various modified examples.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 outlines the entire constitution of the device for producing a low flame propagation cigarette, which manufactures a low flame propagation cigarette and includes a

wrapping-paper inspection means for the low flame propagation cigarette, in an embodiment of the present invention.

Figure 2 is an enlarged diagram showing the periphery of a combustion-adjustor spread region forming unit that is a new constitution of the device for producing a low flame propagation cigarette of Figure 1.

Figure 3A is an enlarged side view showing a roller of the combustion-adjustor spread region forming unit of Figure 2, a combustion adjustor adherer, and a long web of a wrapping paper conveyed by a wrapping-paper conveying unit.

Figure 3B is a front view showing the roller, the combustion adjustor adherer, and the web of Figure 3A.

Figures 4A, 4B, 4C, and 4D show various examples of several combustion adjustor bands of combustion-adjustor spread regions, formed by various combustion-adjustor spread region transfer regions of the outer peripheral surface of the roller, on one surface of the long web of the wrapping paper conveyed by the wrapping-paper conveying unit by the combustion-adjustor spread region forming unit of Figure 2.

Figure 4E is an oblique view showing a state in which the low flame propagation cigarette manufactured by the device of Figure 1 from the long web of the wrapping paper of Figure 4D is connected to a filter and in which a chip paper of the filter is cut and opened.

Figure 5 is an enlarged diagram showing a modified example of the combustion-adjustor spread region forming unit of the device for producing a low flame propagation of Figure 1 and its periphery.

Figure 6A is an enlarged side view showing a modified example of the combustion-adjustor spread region forming unit.

Figure 6B is a front view showing the nozzle of Figure 6A.

Figure 6C is an end surface diagram showing the end surface of a wrapping-paper facing part of the nozzle from the direction opposite to the side view of Figure 6A.

Figure 7 is an enlarged outlined diagram showing a wrapping-paper inspecting unit for a low flame propagation cigarette of the device of Figure 1 and an inferior-product removal unit.

Figure 8A is an outlined plan view showing a state in which the wrapping-paper inspecting unit for a low flame propagation cigarette of Figure 7 inspects several combustion adjustor bands of the combustion-adjustor spread regions formed by the device for producing a low flame propagation cigarette of Figure 1 from the long web of the wrapping paper conveyed by the wrapping-paper conveying unit of Figure 1.

Figure 8B shows results inspected by the wrapping-paper inspecting unit for a low flame propagation cigarette in the manner as shown in Figure 8A.

Figure 9 shows various results that can be inspected by the wrapping-paper inspecting unit for a low flame propagation cigarette of Figure 7.

Figure 10A is an enlarged oblique view showing another example of a low flame propagation cigarette that can be manufactured by the device of the present invention.

Figure 10B is an enlarged oblique view showing another example of a low flame propagation cigarette that can be manufactured by the device of the present invention.

PREFERRED EMBODIMENTS OF THE INVENTION

First, referring to Figure 1, the entire constitution of the device for producing a low flame propagation cigarette in an embodiment of the present invention is outlined.

The constitution of the device for producing a low flame propagation cigarette shown in Figure 1 is the same as the conventional device for producing a cigarette except for a device 10 for manufacturing a wrapping paper for a low flame propagation cigarette and a wrapping-paper inspecting unit 11.

The device for manufacturing a low flame propagation cigarette shown in Figure 1 contains an air-permeable cut-tobacco conveying unit 12. Such a cut-tobacco conveying unit 12 uses an air-permeable conveying unit [sic]. A cut-tobacco supply passage part 14 is extended from the cut-tobacco supply source, which is not shown in the figure, to the cut-tobacco conveying unit 12. From the cut-tobacco supply source not shown in the figure, cut tobacco is conveyed via the cut-tobacco supply passage part 14 to the cut-tobacco conveying unit 12 by an air flow.

The cut tobacco from the above-mentioned cut-tobacco supply source is pressed in an oblong band shape with a prescribed width along the center line of the transport direction (longitudinal direction) of the cut-tobacco carrying unit 12 against the cut tobacco carrying unit 12* at the terminal of the cut-tobacco supply passage part 14 by the air flow.

At the terminal E of the transport direction of the cut-tobacco conveying unit 12, the terminal of the main part of the wrapping-paper conveying unit 18 for conveying the wrapping paper for a cigarette from a wrapping-paper supply source 16 for a cigarette is positioned. In this embodiment, a long web roll 20 as a material of the wrapping paper before being cut into the wrapping paper for each cigarette is freely rotatably disposed in the wrapping-paper supply source 16, and a long web 20a drawn out of the roll 20 by the above-mentioned main part of the wrapping-paper conveying unit 18 for conveying the wrapping paper for a cigarette from the roll 20 is conveyed up to the above-mentioned terminal via a looseness-prevention mechanism.

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* [Japanese text is redundant in many areas.]

In this embodiment, the above-mentioned main part of the wrapping-paper conveying unit 18 includes a number of tension roller pairs, guide roller pairs, and driving roller pairs.

In the wrapping-paper supply source 16, the same type of roll 20' as the roll 20 is freely rotatably disposed. The starting end of a web 20'a of another roll 20' is opposite to the long web 20a drawn out of the wrapping-paper conveying unit 18 from the roll 20 via an automatic connector 21. If the terminal of the web 20a from the roll 20 is detected by the automatic connector 21, the automatic connector 21 connects the starting end of the web 20'a of another roll 20' to the terminal of the web 20a of the roll 20. The web 20'a of another roll 20' subsequent to the web 20a of the roll 20 is then conveyed toward the terminal of the above-mentioned main part of the wrapping-paper conveying unit 18 by the wrapping-paper conveying unit 18*.

The wrapping-paper conveying unit 18 has a wrapping-paper support conveyor 22 subsequent to the terminal of the above-mentioned main part. In this embodiment, the wrapping-paper support conveyor 22 uses a conveyor belt 22a supported by several guide rollers and driving rollers, with the web 20a or 20'a from the terminal of the above-mentioned main part being mounted on the upper horizontal moving part of the conveyor belt 22a and conveyed by the conveyor belt 22a.

At the terminal E in the conveying direction of the cut-tobacco conveying unit 12, tongs not shown in the figure are disposed; at said terminal E, the cut tobacco is guided onto the web 20a or 20'a on the upper horizontal moving part of the conveyor belt 22a by the above-mentioned tongs. The conveying direction of the web 20a or 20'a due to the upper horizontal moving part of the conveyor belt 22a is the same as the conveying direction of the cut tobacco due to the cut-tobacco conveying unit 12, with the center line in the conveying direction of the cut-tobacco conveying unit 12 and the center line in the conveying direction of the upper horizontal moving part of the conveyor belt 22a being opposite to each other in the vertical direction. Therefore, the cut tobacco guided onto the web 20a or 20'a on the upper horizontal moving part of the conveyor belt 22a is deposited in an oblong band shape along the center line in the conveying direction of the web 20a or 20'a on the web 20a or 20'a by the above-mentioned tongs from the terminal E in the conveying direction of the cut-tobacco conveying unit 12.

A wrapping tube unit 23 is disposed along the upper horizontal moving part of the conveyor belt 22a. The wrapping tube unit 23 winds the web 20a or 20'a in which the cut tobacco is deposited in an oblong band shape (i.e., in an oblong cylindrical shape) on the upper horizontal moving part of the conveyor belt 22a along with the advance of the upper horizontal moving part of the conveyor belt 22a.

The wrapping tube unit 23 includes winders 24a and 24b, paste adherer 25, and paste dryer 26 arranged along the conveying direction of the above-mentioned upper horizontal moving part. The winder 24a winds both sides of the web 20a or 20'a in which the cut tobacco is

deposited in an oblong band shape on the upper horizontal moving part, forms a U-shaped cross section, and further bends one side in a tubular shape so that the cut tobacco may be included onto the oblong band-shaped cut tobacco. The paste adherer 25 adheres a paste to the edge of one side of the web 20a or 20'a in an upward raised state. Another winder 24a bends one side of the web 20a or 20'a, in which the paste is adhered to the edge, in a tubular shape toward the edge of the other side that has already been bent in a tubular shape as mentioned above. As a result, the web 20a or 20'a is molded into a cylindrical oblong cigarette bar CB containing the cut tobacco.

The oblong cigarette bar CB dries the paste by passing through the paste dryer 26, is cut into a prescribed length by a cutting unit 28 disposed adjacently to the paste dryer 26, and becomes a cigarette CG with a prescribed length.

In other words, the conveying direction of the long web 20a or 20'a of the wrapping paper conveyed by the wrapping-paper conveying unit 18 is the longitudinal direction when the long web 20a or 20'a of the wrapping paper is wrapped into a cigarette form.

The above constitution mentioned up to now in the device for producing a low flame propagation cigarette shown in Figure 1 is the same as the constitution of the conventional device for producing a cigarette.

As shown in Figure 1, the device 10 for manufacturing a wrapping paper for a low flame propagation cigarette, which is a new constitution, is equipped with a combustion-adjustor spread region forming unit 30 used in combination with the above-mentioned main part of the wrapping-paper conveying unit 18.

Next, in addition to Figure 1, referring to Figure 2 showing the enlarged periphery of the combustion adjustor region forming unit 30 of the device for producing a low flame propagation cigarette of Figure 1, the constitution of the combustion-adjustor spread region forming unit 30 is explained in detail.

Using the combustion adjustor for adjusting the flame propagation of the wrapping paper of the cigarette CG, the combustion-adjustor spread region forming unit 30 forms combustion-adjustor spread regions with a desired pattern on the inner surface when the web 20a or 20'a is wrapped into a cigarette form in the long web 20a or 20'a of the wrapping paper conveyed by the above-mentioned main part of the wrapping-paper conveying unit 18. In this embodiment, the combustion-adjustor spread regions formed on the above-mentioned inner surface by the combustion-adjustor spread region forming unit 30 are several combustion adjustor bands extended along the longitudinal direction (in this embodiment, the conveying direction of the long web 20a or 20'a of the wrapping paper) of the wrapping-paper conveying unit 18 when the web 20a or 20'a is wrapped into a cigarette form.

Such a combustion-adjustor spread region forming unit 30 is equipped with a roller 30a, which can make contact with one surface of the long web 20a or 20'a of the wrapping paper

conveyed by the above-mentioned main part of the wrapping-paper conveying unit 18 and rotates in the above-mentioned conveying direction, and with a combustion adjustor adherer 30b, which supplies the combustion adjustor to the outer peripheral surface of the roller 30a and adheres the combustion adjustor. The roller 30a is rotated and the peripheral velocity is matched with the conveying direction and the conveying speed of the long web 20a or 20'a by a rotary driving source, which is not shown in the figure, in the device for producing a low flame propagation cigarette shown in Figure 1.

The above-mentioned one surface of the long web 20a or 20'a of the wrapping paper becomes an inner surface when the long web 20a or 20'a is wrapped with the above-mentioned cut tobacco into a cigarette form.

The combustion adjustor adherer 30b includes a combustion adjustor tank 32, a pump 34 with a control means connected to said tank, and a combustion-adjustor adhering part 36 that makes contact with the outer peripheral surface of the roller 30a and adheres the combustion adjustor from the combustion adjustor tank 32 to the above-mentioned outer peripheral surface by the pump 34 with the control means.

The wrapping-paper conveying unit 18 includes a wrapping-paper width direction position adjustor 18a, which adjusts a relative width direction position of the long web 20a or 20'a of the wrapping paper to the outer peripheral surface of the roller 30a in the vicinity of the roller 30a of the combustion-adjustor spread region forming unit 30, and also includes a wrapping-paper contact and separation unit 18b that selectively contacts and separates the long web 20a or 20'a conveyed by the wrapping-paper conveying unit 18 to the outer peripheral surface of the roller 30a. The wrapping-paper contact and separation unit 18b separates the web 20a or 20'a from the outer peripheral surface of the roller 30a as shown by an alternating long and short dashed lines in Figure 1 while the device for producing a low flame propagation cigarette of Figure 1 is not operated and makes contact between the web 20a or 20'a and the outer peripheral surface of the roller 30a as shown by a solid line in Figure 1 while the device for producing a low flame propagation cigarette of Figure 1 is operated.

Next, referring to Figures 3A and 3B, the constitution of the roller 30a of the combustion-adjustor spread region forming unit 30 is explained in further detail. Here, Figure 3A is an enlarged side view showing the roller 30a of the combustion-adjustor spread region forming means 30, the combustion adjustor adherer 36, and the long web 20a of the wrapping paper conveyed by the wrapping-paper conveying unit 18. Figure 3B is a front view showing the roller 30a, combustion adjustor adherer 36, and web 20a of Figure 3A.

On the outer peripheral surface of the roller 30a, combustion-adjustor spread region transfer areas correspond to the pattern and number of the combustion-adjustor spread regions formed on the above-mentioned one surface of the web 20a or 20'a by the combustion-adjustor

spread region forming unit 30; in this embodiment, several band-shaped combustion-adjustor spread region transfer areas 38, which are formed in accordance with the interval in the width direction of several combustion adjustor bands 20b formed by extending in the conveying direction of the web 20a or 20'a and that extend in the peripheral direction of the above-mentioned outer peripheral surface, are formed.

The number, width, and mutual gap of several combustion-adjustor spread region transfer areas 38 correspond to the number, width, and mutual gap of several combustion adjustor bands 20b formed on the above-mentioned one surface of the web 20a or 20'a by the combustion-adjustor spread region forming unit 30.

Within the range of the length in the peripheral direction of the outer peripheral surface of the roller 30a, the length of several combustion-adjustor spread region transfer areas 38 in the above-mentioned peripheral direction can be optionally set.

Figures 4A, 4B, 4C, and 4D show various examples of several combustion adjustor bands formed on the above-mentioned one surface of the web 20a of the wrapping paper conveyed by the wrapping-paper conveying unit 30 by various combustion-adjustor spread region transfer areas 38 of the outer peripheral surface of the roller 30a. In these figures, L is the length of one piece of cigarette CG when the wrapping paper constituting the web 20a is wrapped into a cigarette form by the wrapping tube unit 23 of Figure 1 and is cut into the cigarette CG with a prescribed length by the cutting unit 28.

Figure 4A shows several combustion adjustor bands 20b [sic; 30b] continuously formed in the conveying direction of the web 20a from the starting end to the terminal of the long web 20a of the wrapping paper. These continuous combustion adjustor bands 20b are formed by continuously forming each of several combustion-adjustor spread region transfer areas 38 in the above-mentioned peripheral direction of the outer peripheral surface of the roller 30a.

Figure 4B shows several combustion adjustor bands 20b formed at a prescribed interval in the conveying direction of the web 20a from the starting end to the terminal of the long web 20a of the wrapping paper (in the longitudinal direction when the wrapping paper constituting the web 20a is wrapped into a cigarette form by the wrapping tube unit 23 of Figure 1). The above-mentioned prescribed interval corresponds to the length 2L of two pieces of said cigarettes CG.

These combustion adjustor bands 20b formed at a prescribed interval are formed by dividing each of several combustion-adjustor spread region transfer areas 38 in the above-mentioned peripheral direction of the outer peripheral surface of the roller 30a by a peripheral length that is several times the length 2L of two pieces of said cigarettes CG.

The division interval Y between several combustion adjustor bands 20b and the next several combustion adjustor bands 20b in the longitudinal direction can be optionally set.

Figure 4C shows several combustion adjustor bands 20b formed at another prescribed interval of one half of the prescribed interval of Figure 4B in the conveying direction of the web 20a from the starting end to the terminal of the long web 20a of the wrapping paper (in the longitudinal direction when the wrapping paper constituting the web 20a is wrapped into a cigarette form by the wrapping tube unit 23 of Figure 1). The above-mentioned other prescribed interval corresponds to the length L of one piece of said cigarette CG. Also, the above-mentioned other prescribed interval can be further divided into optional sub-intervals.

In this case, the division interval Y between several combustion adjustor bands 20b and the next several combustion adjustor bands 20b in the longitudinal direction can also be optionally set.

These combustion adjustor bands 20b formed at a prescribed interval are formed by dividing each of several combustion-adjustor spread region transfer areas 38 in the above-mentioned peripheral direction of the outer peripheral surface of the roller 30a by a peripheral length that is several times the length L of one piece of said cigarette CG.

Also, several combustion adjustor bands 20b formed by further dividing the above-mentioned other prescribed interval by optional sub-intervals are formed by dividing each of several combustion-adjustor spread region transfer areas 38 in the above-mentioned peripheral direction of the outer peripheral surface of the roller 30a by a peripheral length that is several times the length L of one piece of said cigarette CG and further dividing each of the above-mentioned other prescribed intervals into optional sub-intervals.

Figure 4D shows several combustion adjustor bands 20b formed at another prescribed interval of Figure 4C in the conveying direction of the web 20a from the starting end to the terminal of the long web 20a of the wrapping paper (in the longitudinal direction when the wrapping paper constituting the web 20a is wrapped into a cigarette form by the wrapping tube unit 23 of Figure 1). Furthermore, when the wrapping paper constituting the web 20a is wrapped at the above-mentioned prescribed interval into a cigarette form by the wrapping-paper winder 26 [sic] of Figure 1 and cut into the cigarette CG with a prescribed length by the cutting unit 28, only the lighting end of the cigarette CG is not formed at a prescribed distance X in the longitudinal direction when the above-mentioned wrapping paper is wrapped into a cigarette form.

The above-mentioned prescribed distance X can be set to an optimum value between about 10 mm and about 25 mm.

Also, after the wrapping paper constituting the web 20a is wrapped at the above-mentioned prescribed interval into a cigarette form by the wrapping tube unit 23 of Figure 1, when it is cut into the cigarette CG with a prescribed length by the cutting unit 28, a combustion

adjustor non-spread gap of 1/2·Y is generated at the end that is opposite to the lighting end of the cigarette CG.

In each web 20a of Figures 4B and 4C, the division interval Y between several combustion adjustor bands 20b and the next several combustion adjustor bands 20b in the longitudinal direction generates the combustion adjustor non-spread gap of 1/2·Y at one or both ends of the cigarette CG when the wrapping paper constituting the web 20a is wrapped at the above-mentioned prescribed interval into a cigarette form by the wrapping tube unit 23 of Figure 1 and is then cut into the cigarette CG with a prescribed length by the cutting unit 28.

The above-mentioned interval Y eliminates the possibility that the cutting performance of the wrapping paper after being wrapped into a cigarette form into the cigarette CG by the cutting unit 28 will be lowered due to the attachment of the combustion adjustor to the cutting unit 28 by the contact of the cutting unit 28 with the combustion adjustor bands 20b.

Figure 4E shows a state in which the wrapping paper constituting the web 20a of Figure 4D is wrapped with the cut tobacco T into a cigarette form by the wrapping tube unit 23 of Figure 1 and is cut into the cigarette CG with a prescribed length by the cutting unit 28, with a chip paper CP along with a filter FL being installed in the combustion adjustor non-spread gap of 1/2·Y of the end opposite to the lighting end of the cigarette CG.

The gap with a prescribed distance X without the combustion adjustor bands 20b, formed at the lighting end of the cigarette CG, improves the lighting performance with respect to the above-mentioned lighting end and can avoid the influence of the combustion adjustor bands 20b on the initial smoking taste of cigarette CG immediately after lighting.

Several combustion adjustor bands 20b are formed on the above-mentioned wrapping paper so that after the wrapping paper constituting the web 20a is wrapped at the above-mentioned prescribed interval into a cigarette form by the wrapping tube unit 23 of Figure 1, when it is cut into the cigarette CG with a prescribed length by the cutting unit 28, only the lighting end of the cigarette CG may not be formed at a prescribed distance X in the longitudinal direction when the above-mentioned wrapping paper is wrapped into a cigarette form. This is achieved by forming each of several combustion-adjustor spread region transfer areas 38 of the outer peripheral surface of the roller 30a as follows. In other words, each of several combustion-adjustor spread region transfer areas 38 is divided by the above-mentioned other prescribed interval (that is, L) in the above-mentioned peripheral direction of the outer peripheral surface of the roller 30a by the peripheral length that is several times the length L of one piece of said cigarette CG, and when the wrapping paper constituting the web 20a is wrapped at the above-mentioned other prescribed interval into a cigarette form by the wrapping paper winder 26 [sic] of Figure 1, then cut into the cigarette CG by the above-mentioned other prescribed length by the cutting unit 28, only the lighting end of the cigarette CG is formed by extending the interval with

a prescribed distance X in the longitudinal direction when the above-mentioned wrapping paper is wrapped into a cigarette form.

According to the concept of the present invention, each of several combustion adjustor bands 20b intermittently formed as shown in Figure 4D can also be further divided into optional sub-intervals.

Next, in addition to Figure 1, referring to Figure 5 that is an enlarged diagram showing a modified example of the combustion-adjustor spread region forming unit 30 of the device for producing a low flame propagation cigarette of Figure 1 and its periphery, the constitution of a combustion-adjustor spread region forming unit 30' of the modified example is explained in detail.

The constitution of a combustion-adjustor spread region forming unit 30' of the modified example is equipped with a nozzle 40, which contacts or approaches to the above-mentioned one surface of the long web 20a or 20'a of the wrapping paper conveyed by the main part of the wrapping-paper conveying unit 18, and a combustion adjustor supplier 42 for supplying the combustion adjustor to the nozzle 40.

The combustion adjustor supplier 42 is equipped with a combustion adjustor tank 42b with a press 42a, a pump 42c, a controller 42d connected to the pump 42c, a synchronizer 42e connected to the controller 42d, and a combustion adjustor conveying tube 42f for conveying the combustion adjustor from the pump 42c to the nozzle 40.

Next, referring to Figures 6A, 6B, and 6C, the constitution of the nozzle 40 of the combustion-adjustor spread region forming unit 30' is explained in further detail. Figure 6A is an enlarged side view showing the nozzle 40 of Figure 5, Figure 6B is a front view showing the nozzle 40 of Figure 6A, and Figure 6C is an end surface diagram showing the end surface of a wrapping-paper facing part 40a of the nozzle 40 from the direction opposite to the side view of Figure 6A.

The nozzle 40 includes the tubular wrapping-paper facing part 40a that contacts or approaches the above-mentioned surface of the long web 20a or 20'a of the wrapping paper being conveyed by the main part of the wrapping-paper conveying unit 18 and extends in the width direction of the web 20a or 20'a parallel with the above-mentioned one surface. On the outer peripheral surface of the wrapping-paper facing part 40a, several nozzle holes 40b are formed. In this embodiment, several nozzle holes 40b correspond to the interval in the width direction of several combustion adjustor bands 20b formed by extending in the conveying direction of the web 20a or 20'a on the above-mentioned one surface of the web 20a or 20'a by the combustion-adjustor spread region forming unit 30'.

The number, diameter, and mutual gap of several nozzle holes 40b correspond to the number, width, and mutual gap of several combustion adjustor bands 20b of the combustion-

adjustor spread regions formed on the above-mentioned one surface of the web 20a or 20'a by the combustion-adjustor spread region forming unit 30'.

The synchronizer 42e of the combustion-adjustor supplier 42 supplies a signal required for the controller 42d to control the operation of the pump 42c to the controller 42d so that several combustion adjustor bands 20b may be formed at a desired length in the conveying direction of the web 20a or 20'a for the long web 20a or 20a' of the wrapping paper, which is cylindrically wrapped with the cut tobacco by the wrapping tube unit 23 of the device for producing a low flame propagation cigarette of Figure 1 and is cut into each cigarette CG by the cutting unit 28, based on the length of each piece of cigarette manufactured using the long web 20a or 20'a of the wrapping paper being conveyed by the above-mentioned main part of the wrapping-paper conveying unit 18 by the device for producing a low flame propagation cigarette of Figure 1.

The synchronizer 42e can use an encoder installed in the guide or support rollers in the wrapping-paper conveying unit 18, for instance.

The controller 42d controls the operation of the pump 42c by synchronizing with the feed distance of the web 20a or 20'a corresponding to one piece of the cigarette CB in the wrapping-paper conveying unit 18 that can be detected by the synchronizer 42e. As a result, for example, as shown in Figure 6B, the nozzle 40 can form several desired combustion adjustor bands 20b on the above-mentioned one surface of the corresponding web 20a or 20'a from several nozzle holes 40b.

Needless to say, even if the combustion-adjustor spread region forming means 30' of this modified example is used, referring to Figures 2 and 3, similarly to the combustion-adjustor spread region forming unit 30 using the above-mentioned roller 30a, the combustion-adjustor spread regions with various patterns of the web 20a or 20'a including several combustion adjustor band arrays shown in Figures 4A-4D can be formed at a desired density.

Also, substances usable as combustion adjustors are currently variously known; as examples, proteins such as gelatin, casein, albumin, and gluten; polysaccharides having a tackifying action, such as xanthan gum (echo gum), locust bean gum, guar gum (guar pack), tragacanth, cod gum, tamarind seed polysaccharides (glyroid [transliteration]), karaya gum, gum arabic, pullulan, dextrin, cyclodextrin (oligosebum), and ghatti; polysaccharides having a gelation action such as carrageenan, cardlan [transliteration], agar, gelatin, farcelan [transliteration], pectin, jelan [transliteration] gum, and kelcogel [transliteration]; lipids such as lecithin; natural high-molecular-weight derivatives such as carboxymethylcellulose (CMC), methylcellulose (MC), propylene glycol ester alginate (PGA), and processed starch (for example, phosphoric acid starch); synthetic high-molecular-weight compounds such as sodium polyacrylate and various kinds of high-molecular-weight emulsifiers; inorganic ammonium salts

such as ammonium chloride, ammonium phosphate, ammonium hydrogen phosphate, ammonium dihydrogen phosphate, ammonium bromide, and ammonium sulfate; inorganic hydroxides such as barium hydroxide, calcium hydroxide, and aluminum hydroxide; and inorganic salt flame retardants such as sodium borate, boric acid, zinc chloride, magnesium chloride, calcium chloride, and sodium phosphate can be advantageously used. These combustion adjustors can be used alone or as a mixture of two kinds or more.

Next, in addition to Figure 1, referring to Figures 7-9, a wrapping-paper inspecting unit 11 for a low flame propagation cigarette, which is a new constitution in the device shown in Figure 1, is explained in detail.

Also, Figure 7 is an outlined side view showing the constitution of the wrapping-paper inspecting unit 11 for a low flame propagation cigarette. Figure 8A is an outlined plan view showing a state in which the wrapping-paper inspecting unit 11 for a low flame propagation cigarette of Figure 7 inspects several combustion adjustor bands 20b formed by the device 10 for manufacturing a wrapping paper for a low flame propagation cigarette of Figure 1 from the long web 20a or 20'a of the wrapping paper conveyed by the wrapping-paper conveying unit 18 in said Figure 1. Figure 8B shows results inspected by the wrapping-paper inspecting unit 11 for a low flame propagation cigarette as shown in Figure 8A. Figure 9 shows various inspection results that can be inspected by the wrapping-paper inspecting unit 11 for a low flame propagation cigarette of Figure 7.

As shown in Figure 7, the wrapping-paper inspecting unit 11 for a low flame propagation cigarette is equipped with a light source 50, which is opposite to the above-mentioned one surface on which desired types of several combustion adjustor bands 20b formed by the device 10 for manufacturing a wrapping paper for a low flame propagation cigarette of Figure 1 are formed in the long web 20a or 20'a of the wrapping paper conveyed by the wrapping-paper conveying unit 18 of Figure 1, and equipped with a light intensity detector 52, which is opposite to the other surface positioned on the side opposite to the above-mentioned one surface in the above-mentioned web 20a or 20'a and detects the intensity of light projected from the light source 50 and transmitted through the above-mentioned web 20a or 20'a.

The light source 50 is an illuminator that is parallel with the above-mentioned one surface of the opposite web 20a or 20'a and that extends in the direction (the width direction of the web 20a or 20'a) perpendicular to the conveying direction of the long web 20a or 20'a of the wrapping paper of the wrapping-paper conveying unit 18 as shown by an alternating long and short dashed line in Figure 8A, and the light source illuminates the above-mentioned one surface of the web 20a or 20'a at a uniform illuminance along the above-mentioned width direction.

The light intensity detector 52 is a line sensor that is disposed symmetrically with respect to the light source 50 of the above-mentioned one surface on the above-mentioned other surface

of the web 20a or 20'a and extends in the direction (the width direction of the web 20a or 20'a) perpendicular to the conveying direction of the long web 20a or 20'a of the wrapping paper of the wrapping-paper conveying unit 18 as shown by an alternating long and short dashed line in Figure 8A, with the light intensity detector detecting the intensity of the above-mentioned transmitted light by a CCD (Charge Coupled Device).

Instead of the line sensor, the light intensity detector 52 can also be several spot sensors that are disposed symmetrically with respect to the light source 50 of the above-mentioned one surface on the above-mentioned other surface of the web 20a or 20'a and correspond to only several combustion adjustor bands 20b of the web 20a or 20'a on the line extending in the width direction of the web 20a or 20'a.

A signal processor 54 for processing a signal emitted from the light intensity detector 52 is connected to the light intensity detector 52, and an inferior-product remover is connected to the signal processor 54. Also, the inferior-product remover is usually combined with a filter connector for connecting the filter to the cigarette CG supplied from the cigarette manufacturing device via the chip paper.

Figure 8B shows the detection results by the output from the line sensor of the light intensity detector 52 at the position in the web width direction when several combustion adjustor bands 20b formed on the web 20a shown in Figure 8A are detected by the above-mentioned light intensity detector 52.

As seen from Figure 8B, the light transmittance intensity is weaker in a range WB where the web 20a exists compared to the outside WO of the web 20a at the position in the web width direction, and the light transmittance intensity is further weakened in a small range WC corresponding to several combustion adjustor bands 20b in the range WB where the web 20a exists.

From the degree of output in the small range WC, the density of the combustion adjustor bands 20b corresponding to the small range WC is ascertained, and the width of the combustion adjustor bands 20b corresponding to the small range WC is ascertained from the value of the width of the small range WC. From the number of said small range WC in the range WB in which the web 20a exists, the number of said combustion adjustor bands 20b formed on the web 20a is ascertained, and from the distribution of several small ranges WC in the range WB where the web 20a exists, the distribution of several combustion adjustor bands 20b in the width direction of the web 20a is ascertained. Furthermore, the distance in the width direction between the mutual combustion adjustor bands 20b formed in the web 20a is ascertained from the value of the width among several mutual small ranges WC in the range WB where the web 20a exists.

Figure 9 shows inspection results in which the output from the line sensor of the light intensity detector 52 is processed as a binary signal by the signal processor 54 and in which

various inferiorities and wrapping-paper connecting positions for the combustion-adjustor spread are decided.

In a position-inferiority example, in the output from the line sensor of the light intensity detector 52 at the position in the web width direction, it is decided that the position of one combustion adjustor band 20b among a prescribed number of combustion adjustor bands 20b, to be arranged at a prescribed density in a prescribed array in the width direction of the web 20a, is shifted.

In a non-spread example, in the output from the line sensor of the light intensity detector 52 at the position in the web width direction, it is decided that the formation (spread) of one combustion adjustor band 20b among a prescribed number of combustion adjustor bands 20b, to be arranged at a prescribed density in a prescribed array in the width direction of the web 20a, is not carried out.

In a width-inferiority example, in the output from the line sensor of the light intensity detector 52 at the position in the web width direction, it is decided that the width of one combustion adjustor band 20b among a prescribed number of combustion adjustor bands 20b, to be arranged at a prescribed density in a prescribed array in the width direction of the web 20a, is not a prescribed value.

In a spread-amount-inferiority example, in the output from the line sensor of the light intensity detector 52 at a position in the web width direction, it is decided that the density of two combustion adjustor bands 20b among a prescribed number of combustion adjustor bands 20b, to be arranged at a prescribed density in a prescribed array in the width direction of the web 20a, is not a prescribed value. Here, the density of one band of the above-mentioned two combustion adjustor bands 20b exceeds the upper limit threshold of a prescribed density range (in the output from the above-mentioned line sensor, the lower limit TD of the output range corresponding to the above-mentioned prescribed density range) and is higher than the above-mentioned prescribed density range. The density of the other band does not reach the lower limit threshold of a prescribed density range (in the output from the above-mentioned line sensor, the upper limit TU of the output range corresponding to the above-mentioned prescribed density range) and is lower than the above-mentioned prescribed density.

In the wrapping-paper connection position detection, at the position where the end of the start of the long web 20' of another wrapping paper is connected to the terminal of the long web 20 of one wrapping paper in the wrapping-paper supply source 16 of Figure 1 by the automatic connector 22, in the output from the line sensor of the light intensity detector 52 at a position in the web width direction, it is decided that the paper-transmitting output level of the part where there is no combustion adjustor bands 20b of the web 20a and in which the paper-transmitting output levels in all the prescribed number of combustion adjustor bands 20b to be arranged at a

prescribed density in a prescribed array in the width direction of the web 20a are uniformly lowered, is lower compared with the case in which these levels are normally detected at positions other than the above-mentioned connected position.

When the above-mentioned various inferiorities of several combustion adjustor bands 20b to be formed at a prescribed density in a prescribed array on a long web 20 or 20' of the wrapping paper and the connected position of the long web 20 and 20' of the wrapping paper are detected based on the output from the light intensity detector 52 by the signal processor 54, the timing at which the cigarette CG wrapped at the position of the long web 20 or 20' of the wrapping paper including these inferiorities or connected position is cut from the cigarette bar CB prior to cutting by the cutting unit 28 of Figure 1 can be removed from the normal cigarette CG with the filter by the above-mentioned inferiority-product remover, which is not shown in the figure, can be ascertained using the same constitution as that of the synchronizer 42e having been used in the combustion-adjustor spread region forming unit 30' of the modified example of Figure 5.

Also, needless to say, based on the output from the light intensity detector 52, the signal processor 54 can detect the existence of each of several combustion adjustor bands 20b in the longitudinal direction (the conveying direction of the web 20 or 20' of the wrapping-paper conveying unit 18 in this embodiment) when the long web 20 or 20' of the wrapping paper is wrapped into a cigarette form while the web 20 or 20' is conveyed at a prescribed speed by the wrapping-paper conveying unit 18.

The light intensity detector 52 can then detect the length at which each of the above-mentioned several combustion adjustor bands 20b in the longitudinal direction does not exist, from the time at which each of several combustion adjustor bands 20b is not detected and can detect the conveying speed of the web 20 or 20' of the wrapping-paper conveying unit 18. In the above-mentioned wrapping paper, the above-mentioned several combustion adjustor bands 20b are formed only at a prescribed distance in the longitudinal direction when the long web 20 or 20' of the wrapping paper is cut for each cigarette and is wrapped into a cigarette from the lighting end, and the light intensity detector can also detect the above-mentioned prescribed distance.

Furthermore, the detailed numerical values of the above-mentioned prescribed distance can also be detected, and it can be seen that the above-mentioned prescribed distance is set between about 10 mm and about 25 mm.

Also, according to the concept of the present invention, as shown in Figure 10A, in the method for producing a low flame propagation cigarette of the present invention, needless to say, when the web 20 or 20' conveyed by the wrapping-paper conveying unit 18 is wrapped into a cigarette in the wrapping tube unit 23, several combustion adjustors 20b can be formed at a

desired interval in the longitudinal direction over the entire length in the direction intersecting with the above-mentioned longitudinal direction.

In this case, several combustion adjustor bands 20b in the web 20 or 20' are preferably formed on the inside surface when the web 20 or 20' is wrapped into a cigarette form in the wrapping tube unit 23.

In the combustion-adjustor spread region forming unit 30 shown in Figures 3A and 3B, these several combustion adjustor bands 20b are formed by way of the combustion-adjustor spread region transfer regions extended in the direction along the rotational center line of the roller 30a at several positions mutually separated at a desired distance on the outer peripheral surface of the roller 30a. Also, in the combustion-adjustor spread region forming unit 30' shown in Figures 6A-6C, these several combustion adjustor bands 20b are formed by shortening the jet time of the combustion adjustor from several nozzle holes 40b of the nozzle 40 for the web 20 or 20' being conveyed by the wrapping-paper conveying unit 18.

Also, as shown in Figure 10B, the combustion-adjustor spread regions formed on the web 20 or 20' may also be constituted by the gathering of a number of small points. The combustion-adjustor spread regions constituted by such a gathering of a number of small points may be extended in a band shape in a direction intersecting with that of the longitudinal direction when the web 20 or 20' is wrapped into a cigarette form in the wrapping tube unit 23 on the web 20 or 20' as shown in Figure 10B, and may also be extended in a band shape along the longitudinal direction when the web 20 or 20' is wrapped into a cigarette form in the wrapping tube unit 23 as shown in Figure 4E. Furthermore, the number of these band-shaped combustion adjustor regions can also be optionally set, and the boundary of the band-shaped combustion-adjustor spread regions may also be indistinct. Also, the combustion-adjustor spread regions can be formed with various optional distributions (including the pattern and number) other than the band shape on the web 20 or 20'.

With the constitution of the combustion-adjustor spread regions consisting of a number of small points of the combustion adjustor, a more precise combustion adjustment is made possible.

INDUSTRIAL APPLICABILITY

As seen from the above-mentioned detailed descriptions, according to the device for producing a low flame propagation cigarette of the present invention, even if a lighted cigarette is erroneously left on a combustible material, no scorching is caused until the combustion is extinguished by a combustion adjustor, or the heat of combustion being controlled by the combustion adjustor is removed by the combustible material, so that scorching is prevented from being caused in the combustible material or from advancing so much as in the past. Thus, a low flame propagation cigarette can be manufactured by the present invention.

CLAIMS

1. A method for producing a low flame propagation cigarette, characterized by being equipped with a wrapping-paper conveying process that conveys a wrapping paper (20a, 20a') for a cigarette (CG); a combustion-adjustor spread region-forming process that forms combustion-adjustor spread regions for the wrapping paper (20a, 20a') being conveyed in the wrapping-paper conveying process; a cut-tobacco supply process that supplies cut tobacco (T) to the wrapping paper (20a, 20a') in which the above-mentioned combustion-adjustor spread regions are formed in a special process; a wrapping tube process that wraps the wrapping paper (20a, 20a') to which the cut tobacco (T) is supplied in the cut-tobacco supply process and forms the cut tobacco (T) into a cigarette (CG) form; and a cigarette cutting process that cuts the wrapping paper (CB) wrapped along with the cut tobacco (T) into a cigarette (CG) form in the wrapping tube process in accordance with the length in the longitudinal direction of the above-mentioned cigarette (CG).

2. The method for producing a low flame propagation cigarette of Claim 1, characterized by the fact that in the combustion-adjustor spread region forming process, the operation is carried out by synchronizing with the wrapping-paper cutting operation in the cigarette cutting process.

3. The method for producing a low flame propagation cigarette of Claim 1 or 2, characterized by the fact that a combustion-adjustor spread region inspecting process for inspecting the distribution and density of the combustion adjustor bands formed for the wrapping paper (20a, 20a') in the combustion-adjustor spread region forming process is further provided between the combustion-adjustor spread region forming process and the cut-tobacco supply means.

4. The method for producing a low flame propagation cigarette of Claim 3, characterized by the fact that in the combustion-adjustor spread region inspecting process, light is projected from one surface of the wrapping paper (20a, 20a') for cigarette (CG) after the combustion-adjustor spread regions are formed; the transmitted light is detected from the other surface of the wrapping paper (20a, 20a') for cigarette (CG) after the combustion-adjustor spread regions are formed; and the distribution and density of the combustion-adjustor spread regions formed for the wrapping paper (20a, 20a') is inspected by the intensity distribution of the transmitted light.

5. The method for producing a low flame propagation cigarette of any of Claims 1-4, characterized by the fact that in the combustion-adjustor spread region forming process, when the wrapping paper (20a, 20a') is wrapped into a cigarette (CG) form, the above-mentioned several combustion-adjustor spread regions are formed on the surface that is the inner surface of the wrapping paper.

6. The method for producing a low flame propagation cigarette of any Claims 1-5, characterized by the fact that in the combustion-adjustor spread region forming process, several combustion adjustor bands (20b) extended along the longitudinal direction are formed when the wrapping paper (20a, 20a') is wrapped into a cigarette (CG) form.

7. The method for producing a low flame propagation cigarette of of Claim 6, characterized by the fact that in the combustion-adjustor spread region forming process, several combustion adjustor regions (20b) separated by prescribed intervals in the longitudinal direction and extended along the longitudinal direction are formed when the wrapping paper (20a, 20a') is wrapped into a cigarette (CG) form.

8. The method for producing a low flame propagation cigarette of any of Claims 1-7, characterized by the fact that in the combustion-adjustor spread region forming process, in the above-mentioned wrapping paper (20a, 20a'), the above-mentioned combustion-adjustor spread regions are not formed at a prescribed distance in the longitudinal direction when the above-mentioned wrapping paper is wrapped in a cigarette (CG) form, from the lighting end when the wrapping paper is cut for each cigarette.

9. The method for producing a low flame propagation cigarette of Claim 8, characterized by the fact that the above-mentioned prescribed distance is preferably set in a range of about 10-25 mm.

10. The method for producing a low flame propagation cigarette of any of Claims 1-9, characterized by the fact that in the combustion-adjustor spread region forming process, a roller (30a) makes contact with the above-mentioned wrapping paper (20a, 20a') being conveyed in the wrapping-paper conveying process and rotates in the above-mentioned conveying direction; combustion-adjustor spread region transfer regions (38a) corresponding to the above-mentioned combustion-adjustor spread regions are formed on the outer peripheral surface of the above-mentioned roller; and the combustion adjustor is supplied to the outer peripheral surface of the

above-mentioned roller from a combustion adjustor adherer (36), so that the combustion adjustor is adhered.

11. The method for producing a low flame propagation cigarette of any of Claims 1-9, characterized by the fact that in the combustion-adjustor spread region forming process, a nozzle (40a) contacts or approaches the above-mentioned wrapping paper (20a, 20a') being conveyed by the wrapping-paper conveying process; several nozzle holes (40b) are formed in the nozzle; and the combustion adjustor is supplied to the above-mentioned nozzle from a combustion adjustor supplier (42).

12. A device for producing a low flame propagation cigarette, characterized by being equipped with a wrapping-paper conveying unit (18) that conveys wrapping paper (20a, 20a') for cigarette (CG); a combustion-adjustor spread region forming unit (30, 30') that forms combustion-adjustor spread regions for the wrapping paper (20a, 20a') conveyed by the wrapping-paper conveying unit (18); a cut-tobacco supply unit (12) that supplies cut tobacco (T) to the wrapping paper (20a, 20a') in which the above-mentioned combustion-adjustor spread regions are formed by the combustion-adjustor spread region forming unit (30); a wrapping tube unit (23) that wraps the wrapping paper (20a, 20a') to which the cut tobacco (T) is supplied by the cut-tobacco supply unit (12) and forms the cut tobacco (T) into a cigarette (CG) form; and a cigarette cutting unit (28) that cuts the wrapping paper (20, 20a') wrapped along with the cut tobacco (T) into a cigarette (CG) form by the wrapping tube unit (23) in accordance with the length in the longitudinal direction of the above-mentioned cigarette (CG).

13. The device for producing a low flame propagation cigarette of Claim 12, characterized by the fact that the combustion-adjustor spread region forming unit (30, 30') forms the combustion-adjustor spread regions for the wrapping paper (20a, 20a') by synchronizing with the wrapping-paper cutting operation in the cigarette cutting unit (28).

14. The device for producing a low flame propagation cigarette of Claim 12 or 13, characterized by the fact that a combustion-adjustor spread region inspecting unit (11) for inspecting the distribution and density of the combustion-adjustor spread regions formed for the wrapping paper (20a, 20a') by the combustion-adjustor spread region forming unit (30, 30') is further provided before the supply of the cut tobacco (T) by the cut-tobacco supply unit (12) after the formation of the combustion-adjustor spread regions for the wrapping paper (20a, 20a') by the combustion-adjustor spread region forming unit (30, 30').

15. The device for producing a low flame propagation cigarette of Claim 14, characterized by the fact that in the combustion-adjustor spread region inspecting unit (11), light is projected from one surface of the wrapping paper (20a, 20a') for cigarette (CG) after the combustion-adjustor spread regions are formed; the transmitted light is detected from the other surface of the wrapping paper (20a, 20a') for cigarette (CG) after the combustion-adjustor spread regions are formed; and the distribution and density of the combustion-adjustor spread regions formed for the wrapping paper (20a, 20a') are inspected by the intensity distribution of the transmitted light.

16. The device for producing a low flame propagation cigarette of any of Claims 12-15, characterized by the fact that the combustion-adjustor spread region forming unit (30, 30') is disposed such that it can make contact with the wrapping paper (20a, 20a') conveyed by the wrapping-paper conveying unit (18) and is provided with a wrapping-paper contact and separation unit (18b) for selectively contacting the wrapping paper (20a, 20a') conveyed by the wrapping-paper conveying unit (18) to and from the combustion-adjustor spread region forming unit (30, 30').

17. The device for producing a low flame propagation cigarette of Claim 16, characterized by the fact that the wrapping-paper contact and separation unit (18b) separates the above-mentioned wrapping paper from the combustion-adjustor spread region forming unit (30, 30') while conveying of the wrapping paper (20a, 20a') of the wrapping-paper conveying unit (18) is stopped.

18. The device for producing a low flame propagation cigarette of any of Claims 12-17, characterized by the fact that in the combustion-adjustor spread region forming unit (30, 30'), several combustion adjustor bands (20b) extended along the longitudinal direction are formed when the wrapping paper (20a, 20a') is wrapped into a cigarette (CG) form.

19. The device for producing a low flame propagation cigarette of Claim 18, characterized by the fact that in the combustion-adjustor spread region forming unit (30, 30'), several combustion adjustor bands (20b) separated by prescribed intervals in the longitudinal direction and extended along the longitudinal direction are formed when the wrapping paper (20a, 20a') is wrapped into a cigarette (CG) form.

20. The device for producing a low flame propagation cigarette of any of Claims 12-19, characterized by the fact that in the combustion-adjustor spread region forming unit (30, 30'), in

the above-mentioned wrapping paper (20a, 20a'), the above-mentioned combustion-adjustor spread regions are not formed at a prescribed distance (X) in the longitudinal direction when the above-mentioned wrapping paper is wrapped in a cigarette form from the lighting end when the wrapping paper is cut for each cigarette (CG).

21. The device for producing a low flame propagation cigarette of Claim 20, characterized by the fact that the above-mentioned prescribed distance (X) is preferably set in a range of about 10-25 mm.

22. The device for producing a low flame propagation cigarette of any of Claims 12-21, characterized by the fact that the combustion-adjustor spread region forming unit (30, 30') forms the above-mentioned combustion-adjustor spread regions on the inner surface when the wrapping paper is wrapped into a cigarette (CG) in the wrapping paper (20a, 20a').

23. The device for producing a low flame propagation cigarette of any of Claims 12-22, characterized by the fact that the conveying direction of the wrapping paper (20a, 20a') in the wrapping-paper conveying unit (18) is the longitudinal direction when the wrapping paper is wrapped into a cigarette (CG) form; with the combustion-adjustor spread region forming unit (30) being equipped with a roller (30a) that makes contact with the above-mentioned wrapping paper conveyed by the wrapping-paper conveying unit (18) and rotates in the above-mentioned conveying direction, combustion-adjustor spread region transfer regions (42) formed in accordance with the above-mentioned combustion-adjustor spread region on the outer peripheral surface of the above-mentioned roller (30a), and a combustion adjustor adherer (36) that supplies the combustion adjustor to the outer peripheral surface of the above-mentioned roller (30a) and adheres the combustion adjustor.

24. The device for producing a low flame propagation cigarette of any of Claims 12-22, characterized by the fact that the conveying direction of the wrapping paper (20a, 20a') in the wrapping-paper conveying unit (18) is the longitudinal direction when the wrapping paper (20a, 20a') is wrapped into a cigarette (CG) form; with the combustion-adjustor spread region forming unit (30') being equipped with a nozzle (40a) that contacts or approaches the above-mentioned wrapping paper (20a, 20a') conveyed by the wrapping-paper conveying unit (18), several nozzle holes (40b) formed in the nozzle (40a), and a combustion adjustor supplier (42) that supplies the combustion adjustor to the above-mentioned nozzle (40a).

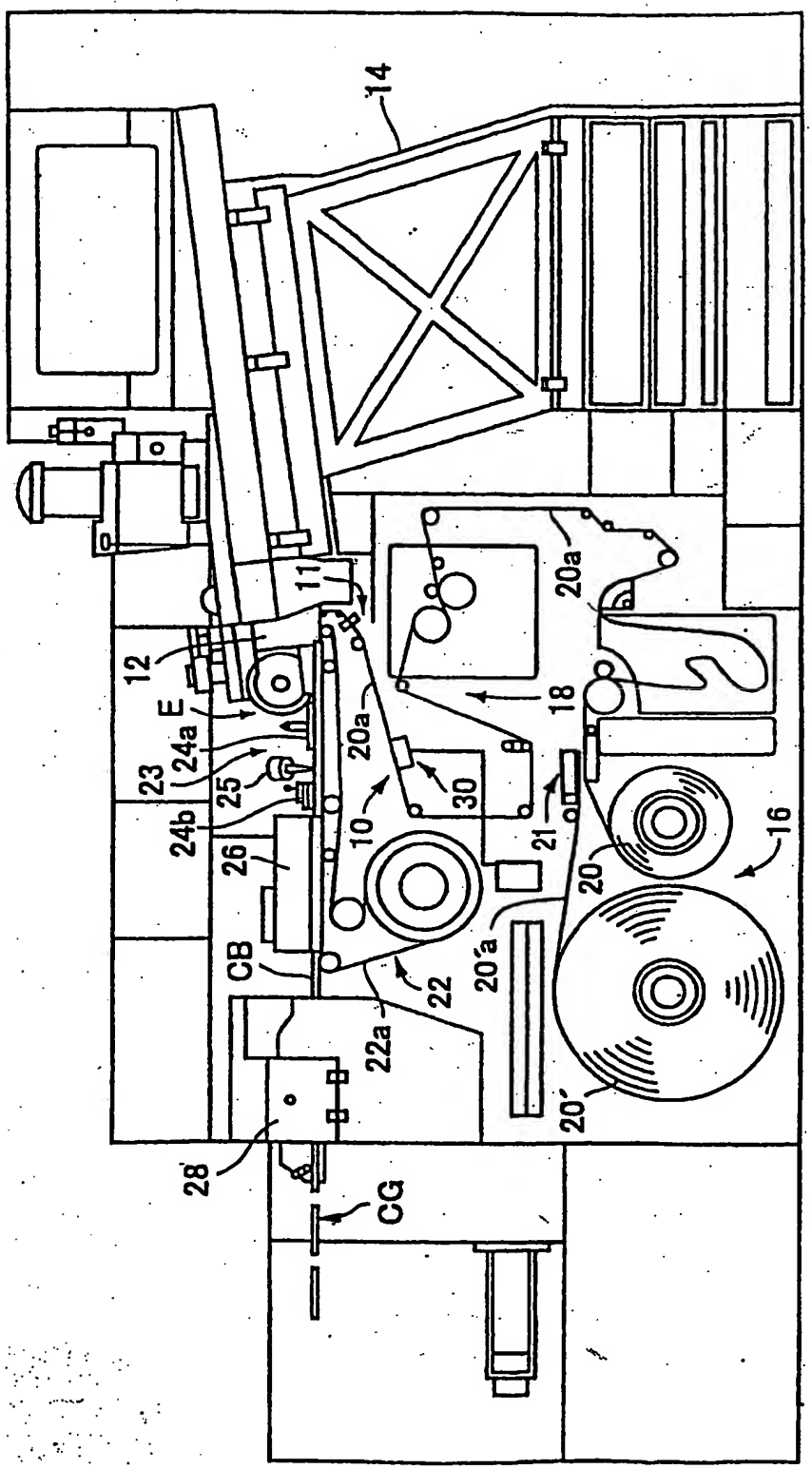

14
11
12
E
24a
23
25
24b
26
CB
28
CG
22
22a
10
30
18
20a
21
20
20'a
20'
16

FIG. 1

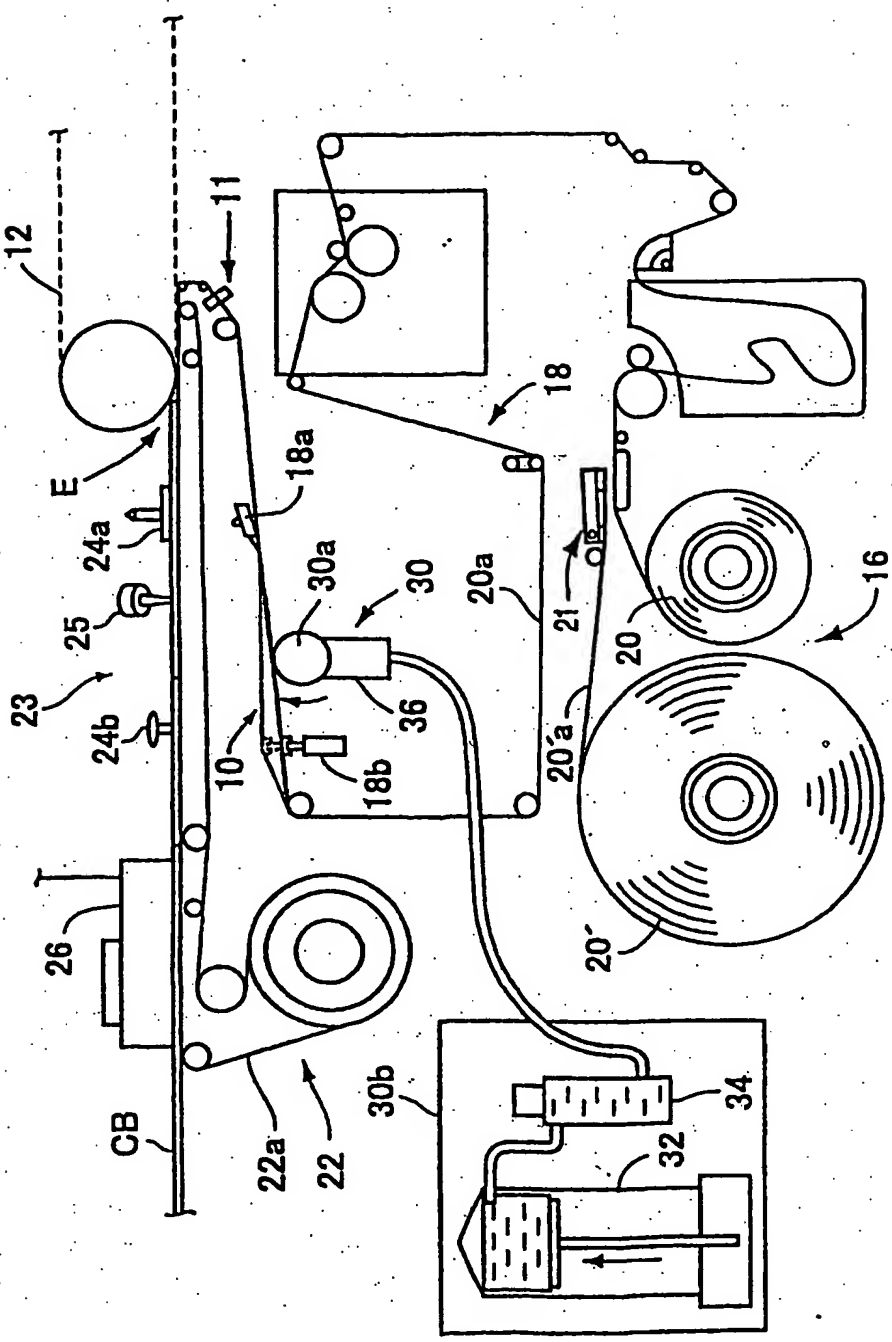

12
11
E
18
18a
24a
30a
30
20a
21
16
25
20
23
24b
36
10
18b
20'a
26
20'
30b
34
CB
22a
22
32

FIG. 2

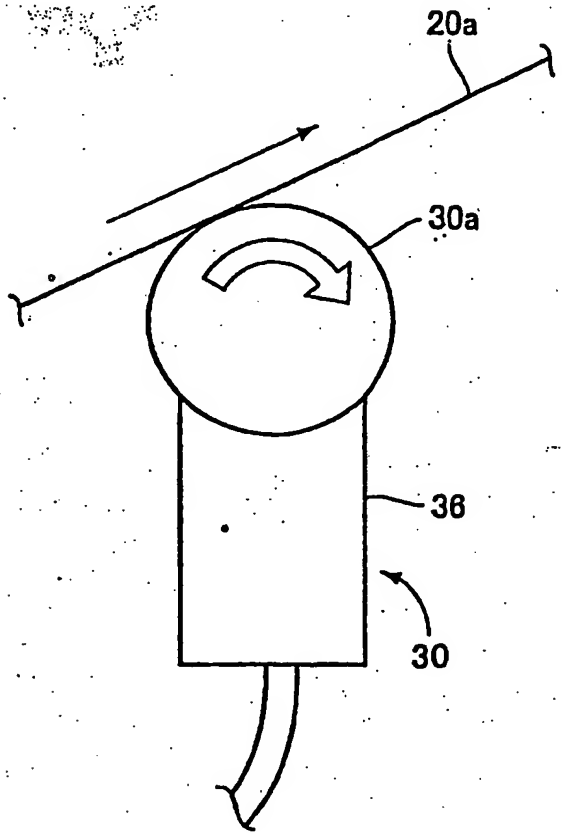


FIG. 3A

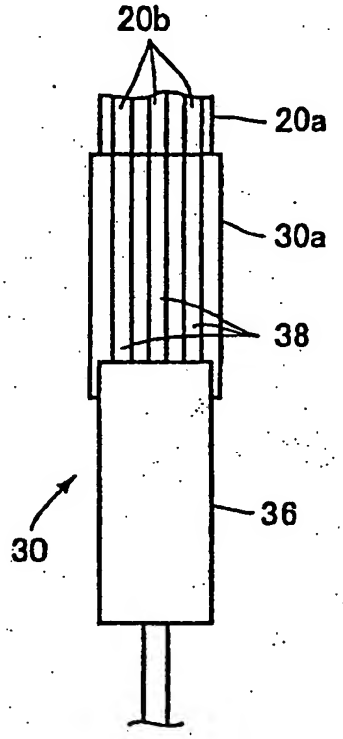


FIG. 3B

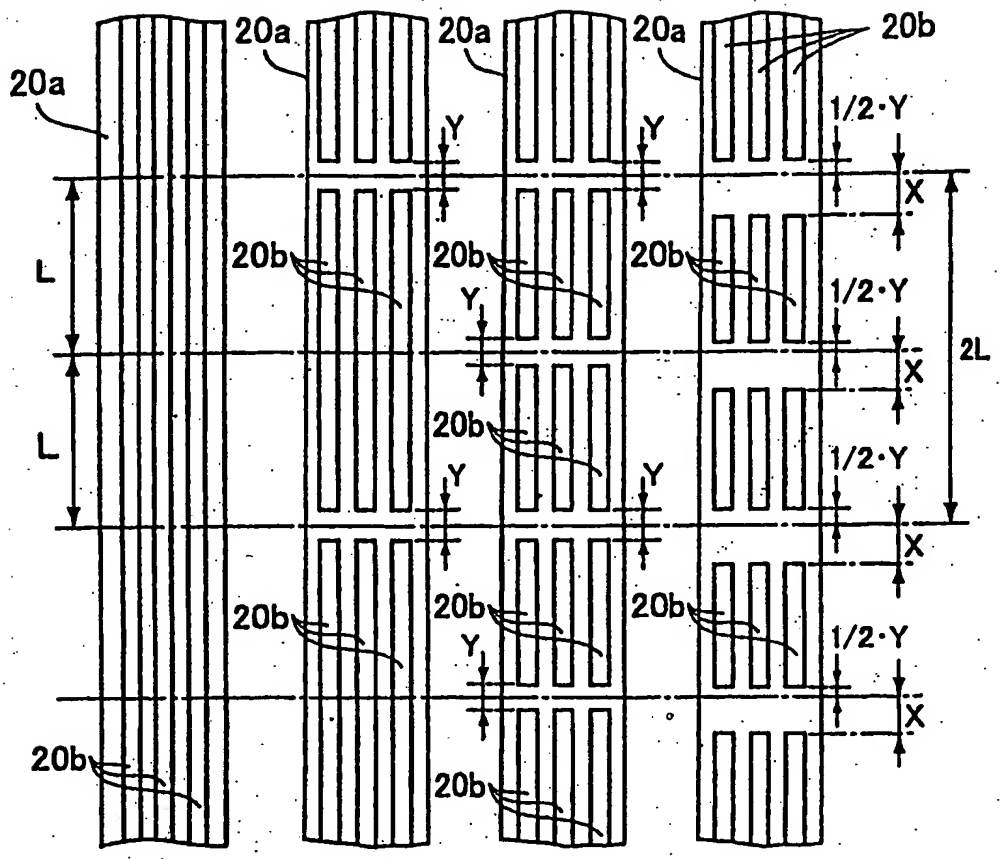


FIG. 4A FIG. 4B FIG. 4C FIG. 4D

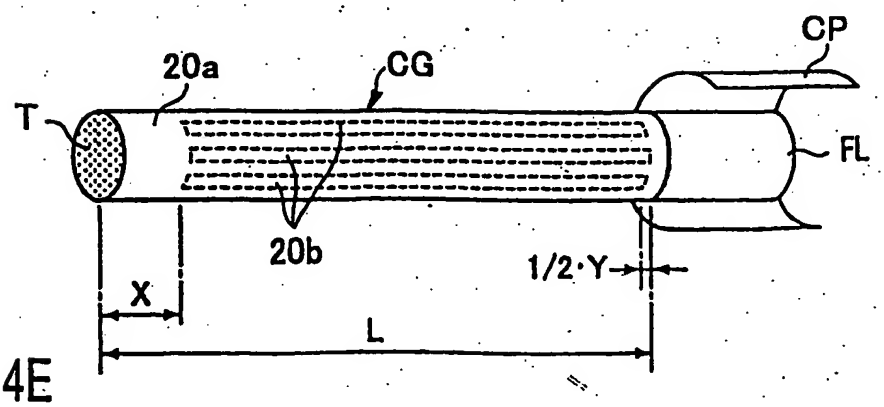


FIG. 4E

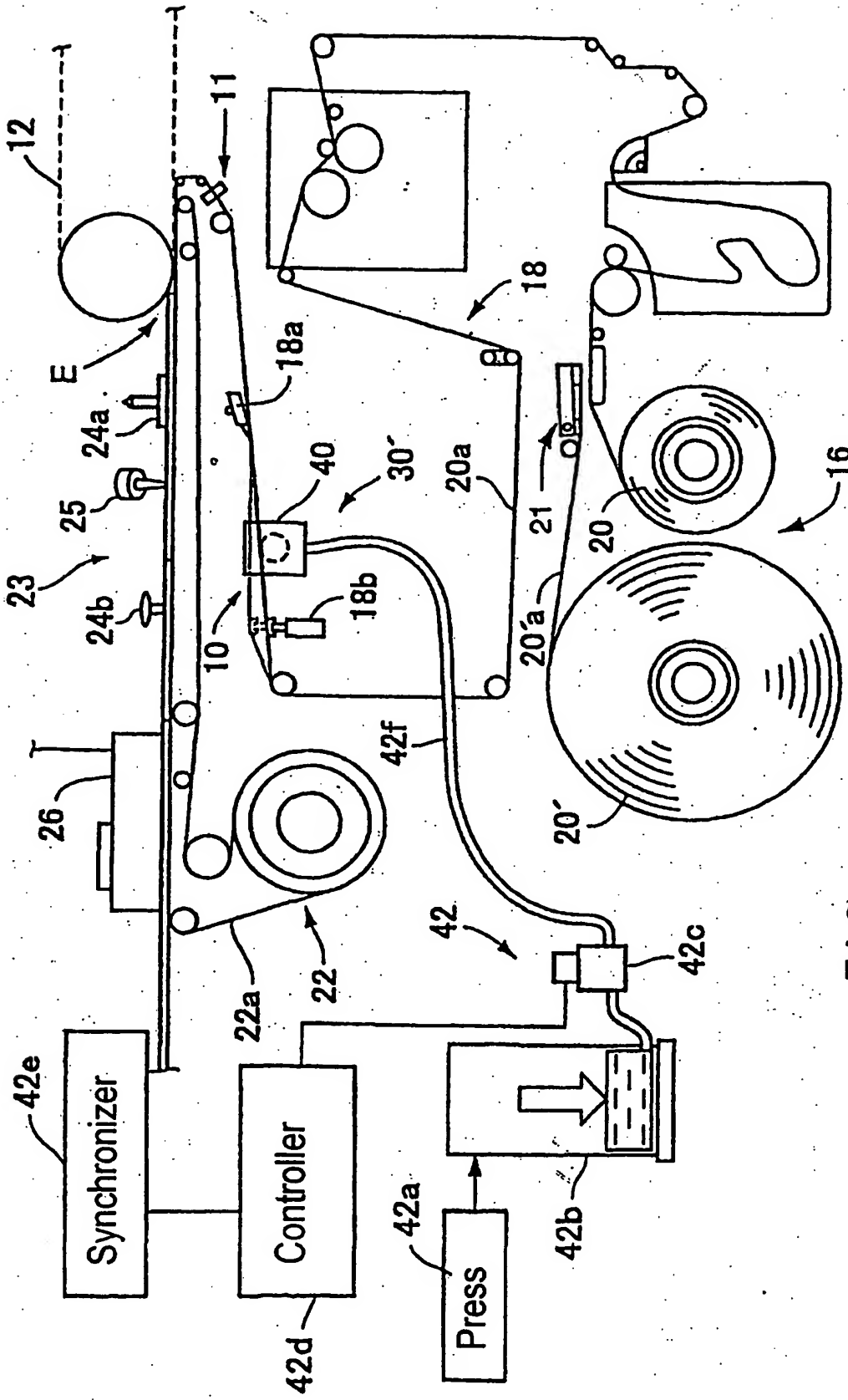

12
11
E
24a
25
23
24b
10
18a
40
30'
18b
20a
21
18
16
20
20'a
20'
26
42f
22
22a
42
42c
42e
Synchronizer
Controller
42d
42a
Press
42b

FIG. 5

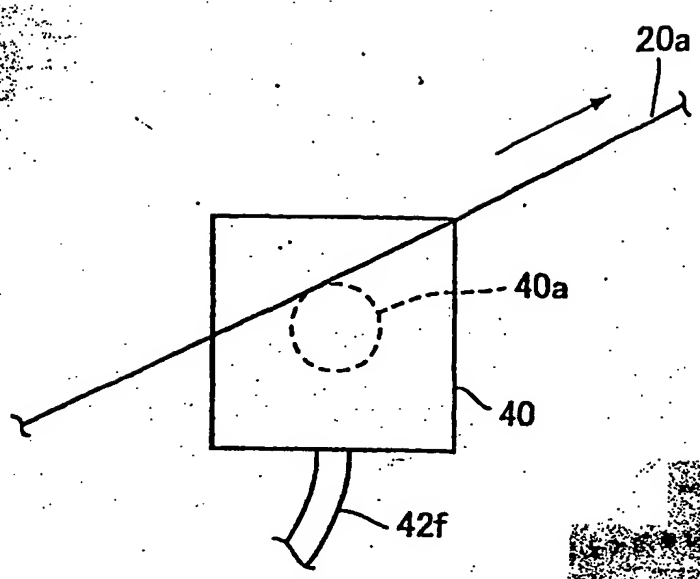


FIG. 6A

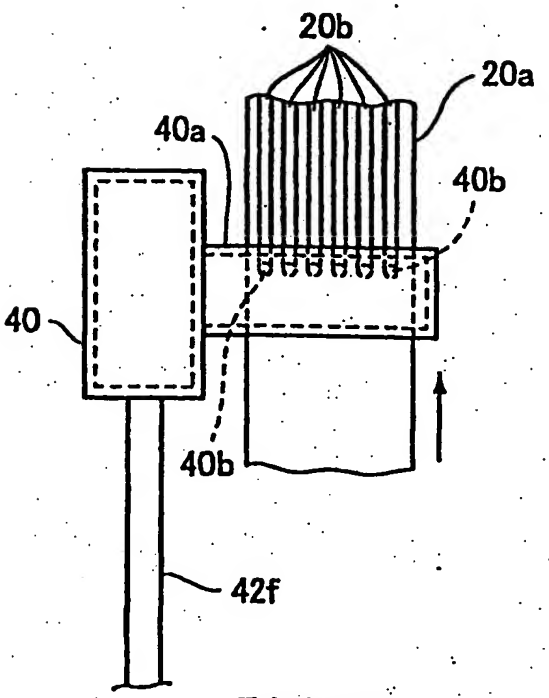


FIG. 6B

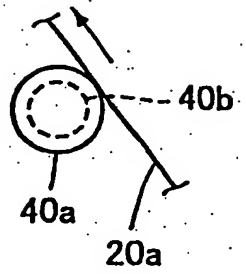


FIG. 6C

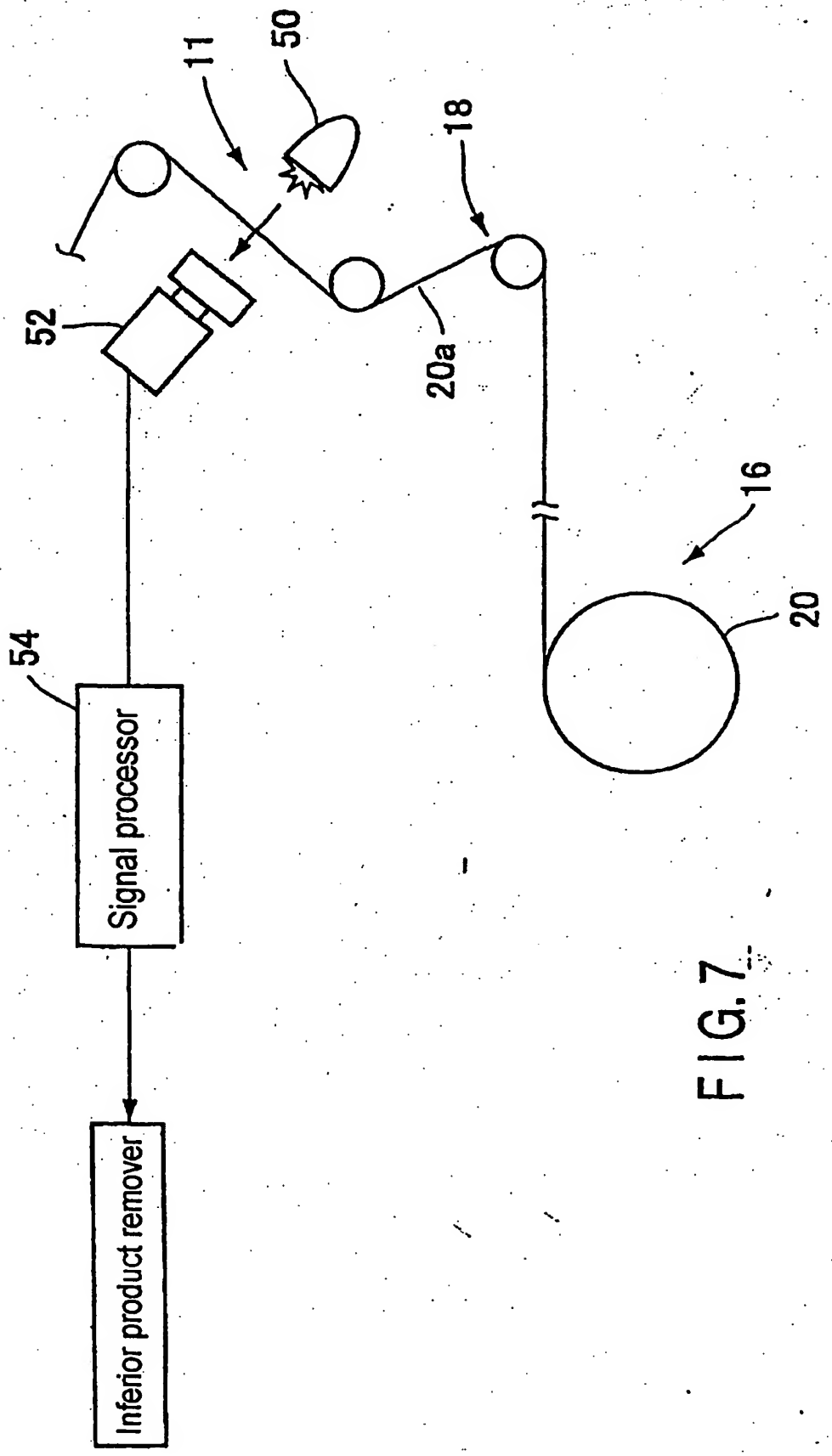

11
50
18
52
20a
16
20
54
Signal processor
Inferior product remover

FIG. 7.

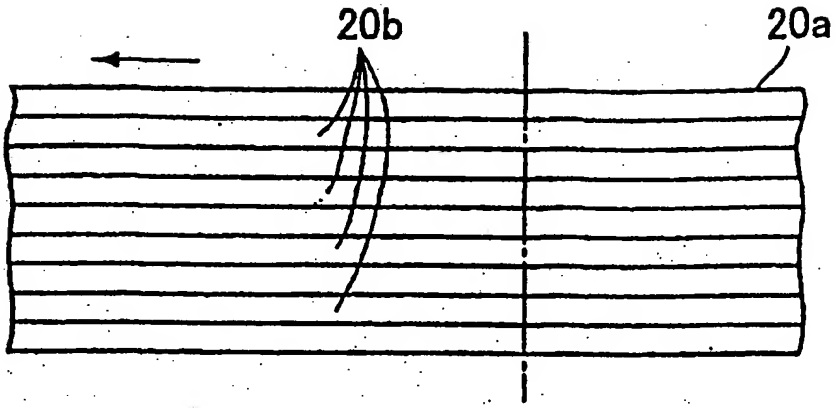

20b
20a

FIG. 8A

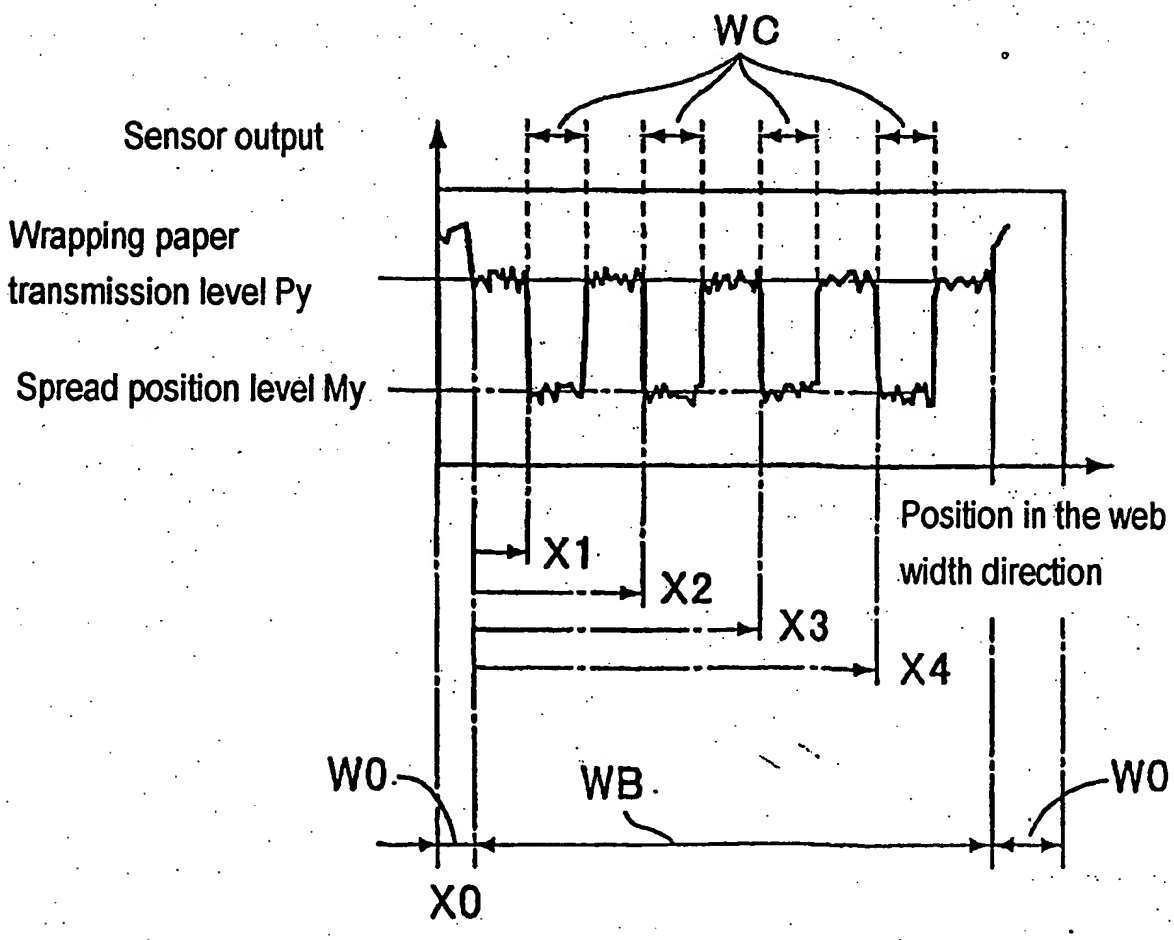

WC
Sensor output
Wrapping paper
transmission level Py
Spread position level My
Position in the web
width direction
X1
X2
X3
X4
W0
WB
W0
X0

FIG. 8B

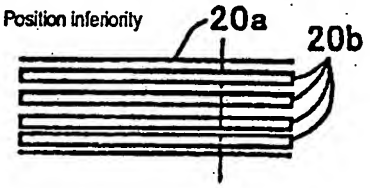
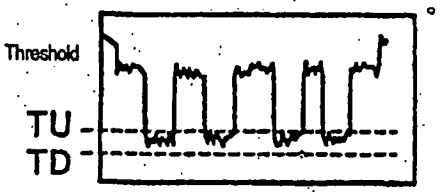
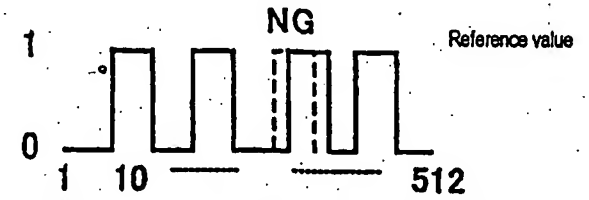
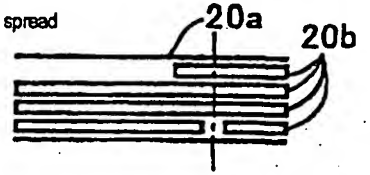
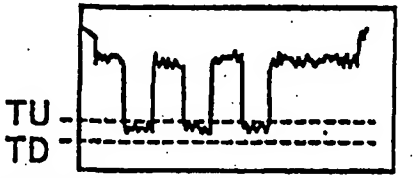
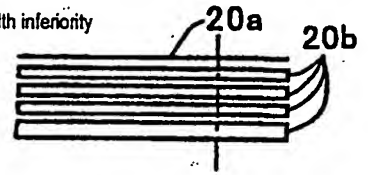
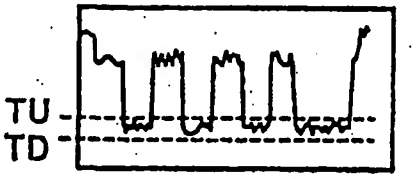
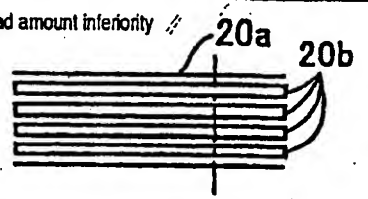
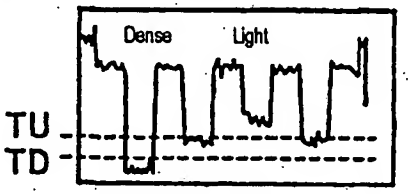
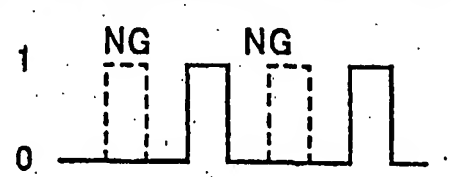
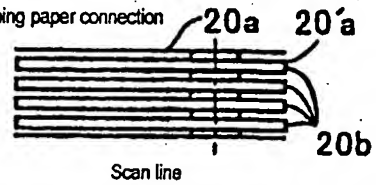
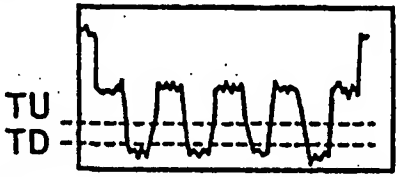
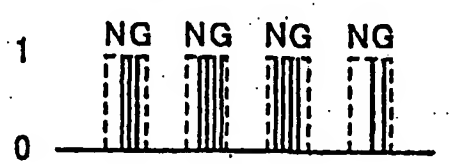
Inferiority classification Wrapping paper connection position detection	Sensor output example	Sensor output example
Position inferiority 		
No spread 		
Width inferiority 		
Spread amount inferiority 		
Wrapping paper connection 		

FIG. 9

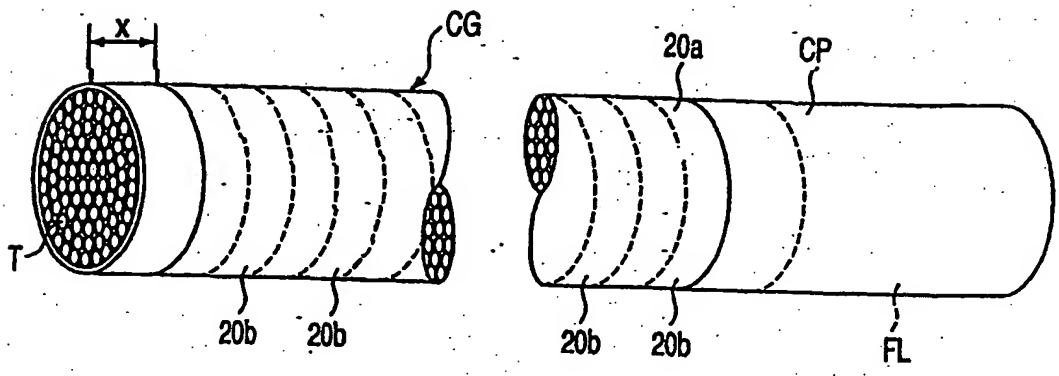


FIG. 10A

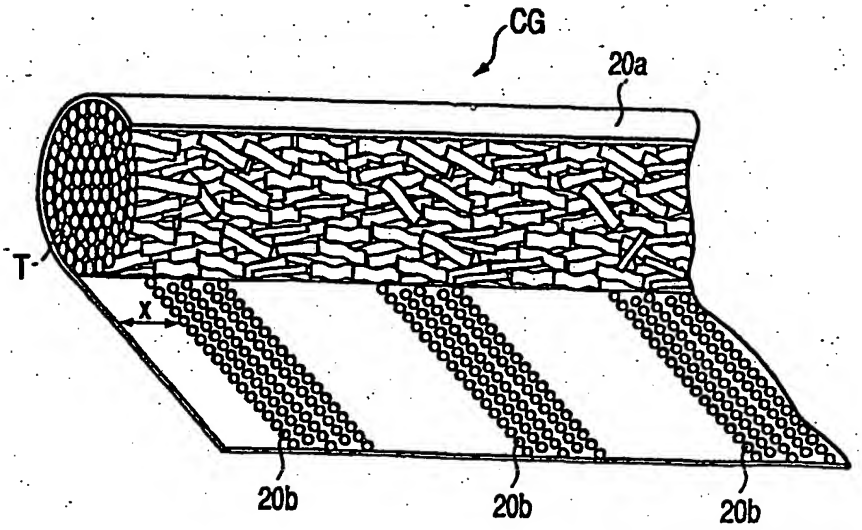


FIG. 10B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/07796

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] A24C5/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] A24C5/00-5/34

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 63-116684 A (Korber AG), 20 May, 1988 (20.05.88), & IT 1222652 B & DE 3631227 A & GB 2196829 A & US 4844100 A1	1-24
Y	JP 4-293478 A (Philip Morris Incorporated), 19 October, 1992 (19.10.92), & AU 637265 B & FI 915098 A & CA 2054219 A & NO 914243 A & EP 483998 A1 & US 5191906 A1	1-24
Y	JP 64-43177 A (Kober AG), 15 February, 1989 (15.02.89), & GB 2207594 A & CN 1030863 A & DE 3725364 A & US 4878506 A1 & IT 1226724 B	3-11,14-24
Y	JP 59-151880 A (Hauni-Werke Kober & Co. KG), 30 August, 1984 (30.08.84), & DE 3345608 A & FR 2540352 A & GB 2134368 A & US 4574816 A1 & IT 1173189 B	3-11,14-24

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 September, 2001 (21.09.01)	02 October, 2001 (02.10.01)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)